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ON THE VERTICAL AND BATHYMETRICAL DISTRIBUTION OF THE BRITISH NON-MARINE MOLLUSCA, WITH SPECIAL REFERENCE TO THE COTTESWOLD FAUNA.

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For some years past I have taken a particular and practical interest in that branch of zoogeography and phytogeography pertaining to vertical or perpendicular distribution. This line of research and inquiry has been undertaken with special reference to the elucidation of the various problems connected with the organic and physical environment of animals and plants, and the morphological characters assumed in consequence of the preponderating influence of either one or the other of these two opposing factors.

As regards geographical or horizontal distribution, much has been accomplished by various specialists in the different departments of biological science. On the other hand, the study of vertical distribution has been negatively conspicuous by reason of its almost total exclusion from the domain of geographical investigation. This is at all events perfectly correct so far as the fauna is concerned ; the flora, on the other hand, it is true, at least in Europe, has received some share of attention at the hands of Prof. Christ, Mr. Ball, and others, and in our own country more especially by Dr. H. C. Watson.

This is wholly inexplicable when one considers how important a matter vertical distribution is, and in the British Isles in particular it is fraught with a considerable degree of scientific interest; for, as is well known to students of physical geography, vertical distribution estimates the affinities existing between the fauna and flora of disconnected and isolated mountain chains and far-distant latitudes. As far as the British Isles are concerned, it affords a very efficient indication of the affinities existing, on the one hand, between the montanic molluscous forms inhabiting all the higher altitudes in the mountain districts of the British Archipelago and their equivalents or representatives occurring at lower altitudes in more boreal latitudes—that is, in the Arctic and sub-Arctic regions of Scandinavia, Russia, Siberia, and North America; and, on the other hand, at higher elevations still in the Alpine and sub-Alpine areas occupied by the Alps, Pyrenees, Carpathians, and other elevated mountain ranges of Central and Southern Europe. Then, again, some of the lowland and maritime forms occurring exclusively in the South of England, Wales, and Ireland possess their nearest relatives and allies in the more austral region of the Lusitanian Conchological Province (in the South of France and in the Iberian Peninsula). It is thus evident that vertical distribution provides a better index concerning the extreme range of temperature and other climatic phenomena which each species can endure than mere geographical distribution is capable of accomplishing in anything like the same space upon the horizontal isotherms. For example, there are greater differences of temperature experienced in ascending a hill only three thousand feet in elevation than there exists between the Scilly Isles and the extreme north of the Shetland Islands, which are distant from one another about seven hundred miles. On the average it will be found that the distance afforded by two degrees of latitude (*i. e.* one hundred and thirty-nine miles) either in a boreal or austral direction is capable of producing only a difference in the mean annual temperature of about one degree Fahrenheit, which a trifling vertical ascent or descent of a hundred yards will accomplish upon the side of any hill. This is well exemplified in Dr. H. C. Watson's well-known treatise entitled 'Cybele Britannica,' which deals with the geographical and vertical distribution of the British

phanerogamic vegetation and Filices, and in which work a series of vertical or ascending zones will be found described for every latitude in the British Isles. In the 'Entomologist' for January, 1894, I also proposed and tabulated a similar series for the purpose of studying the perpendicular distribution of the British Lepidoptera, based principally on the statistics given in the 'Meteorological Atlas of the British Isles,' published by the Council of the Royal Meteorological Society, at the same time giving their equivalents in the principal mountain ranges of Central and Southern Europe, as well as in Scandinavia, for purposes of comparison. These would suffice equally well for the Mollusca.

The Bathymetrical Distribution of the British non-Marine Fauna, particularly the Mollusca, opens up another important field for investigation and inquiry which has hitherto been very badly neglected, if not, indeed, wholly ignored. It is easy to understand that the practical study of the depths to which the Marine Mollusca descend is beyond the power of most individual students, by reason of the elaborate preparations necessary in conducting dredging operations and the expense entailed thereby. But its application to the freshwater denizens of our lakes and extensive expanses of water prevailing more particularly in the northern parts of these islands, would afford much less difficulty of attainment, and the results accruing therefrom would no doubt be of inestimable service to zoology, as has recently been the case in the bathymetrical investigation of the fauna of the Alpine tarns in Switzerland.

It has been my good fortune, from a conchological point of view, to be located during the past season on the plateau of the Cotteswolds in Gloucestershire at an altitude of close upon 1000 ft. above the sea-level. The range of elevation is not great from the point of view of the study of the vertical distribution of the Mollusca, only three points in the whole chain—which extends from Bath in the south-west to near Stratford-on-Avon in the north-east—just exceeding 1000 ft. above the sea-level, the average elevation of most of the hills being between 500 ft. and 900 ft. The entire district therefore comes within Dr. H. C. Watson's two lowest climatal or phytogeographical zones, namely, his lower agrarian and mid-agrarian zones. The

former of these attains to the altitude of about 850 ft. above Gloucester city, which is itself about 50 ft. above the sea-level, high spring tides still continuing further up the river to occasionally as far as Upton-on-Severn, near Malvern. This belt terminates upwards at the point where the graceful climbing *Clematis vitalba* ceases to flourish, for, although it may be seen in the greatest luxuriance up to 600 ft. or so, it can occasionally be met with in the shape of dwarfed and stunted specimens for another 300 ft. higher still, within the protection of woods, deserted stone-quarries, and other sheltered situations. From 50 ft. to 600 ft. above sea-level it climbs over the trees and hedges in such profusion that it constitutes in places quite a characteristic feature in the landscape, and by reason of its great luxuriance affords an almost subtropical aspect and appearance. The range of mean annual temperature of this zone is from 50° to 47° Fahrenheit.

The mid-agrarian zone of Dr. Watson rises above the preceding belt, and embraces all the summits of the hills upwards of 900 ft., and most of the escarpment plateau as well, where the distinctive Cotteswold fauna and flora predominate. It only occupies, however, an exceedingly circumscribed area in all. Now, although, as it will be perceived, the altitude is not great, I hope to show in the following account of the local Terrestrial Mollusca that something can be accomplished even in this restricted perpendicular area in studying their vertical distribution, and in the influence of altitude upon their morphology. It must be considered, however, only as an outline of my observations. I have not included the fluviatile forms for the simple reason that I have as yet not paid particular attention to them in the Cotteswolds, where they are apparently not very conspicuous in consequence of the scarcity of the necessary element, springs and small brooks being plentiful enough, but pools and ponds almost entirely absent, and what few there are at the higher levels becoming mostly dried up during the summer months.

The geological formation of the Cotteswolds consists of the oolite, which contains an abundance of lime; consequenly Terrestrial Mollusca are exceedingly numerous both as regards species and individuals. And the beautiful beech woods which

extend for miles in various directions, especially along the picturesque western escarpment, in many of the "combes," and frequently crest the higher ridges, constitute the habitat of many "good things" which are very scarce or local elsewhere; while the numerous parish commons, covered with their characteristic grasses and aromatic herbage, afford a happy hunting-ground for the heath-snails and other species which frequent such situations.

The whole district forcibly reminds one of the chain of the Jura Mountains between France and Switzerland, where the Jurassic system is so magnificently developed. Of these distant mountains the Cotteswolds seem, as it were, a small detached fragment, considering their similarity not only in the geology but in the fauna and flora as well, though of course all existing here are on a comparatively much inferior scale. In the extensive beech forests of the Jura, the same as in the beech woods here, one may meet with *Ena montana* and *E. obscura* climbing up the smooth tree-trunks in company with *Clausilia bidentata* and *C. laminata*, with its white variety *albida*, while upon the ground the gigantic *Helix pomatia* is equally at home.

Although the last-named species is found on the Continent in a great variety of situations, such as upon grassy banks by the roadside, and even in gardens remote from woods, in the Cotteswolds it is apparently confined exclusively to the arboreal areas, many yards from the beneficent shelter of which it seldom strays, at least, according to my own observations. Here it ascends to about 950 ft. above the sea-level—that is, to the extreme upper limits of the arborescent vegetation—and would no doubt continue to ascend for another two or three thousand feet still if the wooded hills were of a sufficient elevation, as I have seen it up to at least 5000 ft. in the Eastern Alps (in the Canton of the Grisons), which is well within the Lower Alpine or Pseudo-sub-Arctic zone, or belt of conifers.

Respecting the influence of altitude and environment upon their morphology, it is interesting to note that there are two extreme forms of the shell as regards coloration in the Cotteswolds. The first, which I distinguish as var. *arborea* (mihi), is a dark one inhabiting the deep recesses of the woods between 400 ft. and 750 ft., where it is difficult to discern by reason of its

close resemblance to the russet-brown beech-leaves which bestrew the ground, and among which it crawls. The second form, which I call the var. *petrea* (mihi), is of a light "sun-washed" appearance, with the band very indistinctly marked, closely approximating in extreme examples to the var. *albida*. This form occurs principally on the more open, stony, bush-covered, semi-precipitous slopes of the escarpment, generally at a higher altitude than the preceding, to which, however, it is similar as regards size. This likewise possesses a remarkable resemblance to its environment, looking wonderfully like the pale yellow oolitic stones among which it exists.

Although some may be inclined to consider both these cases as protective resemblance, pure and simple, and attribute them to the preponderating influence of the organic environment, I have been compelled to modify the views which I formerly held in this respect in connection with the Lepidoptera (as published in the 'Entomologist' and elsewhere), and have since arrived at the conclusion, from more mature deliberation and practical investigation in the Himalayas and other mountain ranges in Europe and Asia, that the physical environment is a factor of at least equal importance in deciding the morphological characters of animals, though not so potent possibly, except perhaps indirectly, in fixing their geographical and vertical distribution, and this principally in an equatorial or downward direction. I therefore do not consider the two cases described in connection with this king of the Cotteswold Mollusca to be examples of protective resemblance at all, though they superficially possess the appearance of such, but to be due either directly or indirectly to the preponderating influence of the physical environment. In support of this contention concerning the species under consideration, I may state that I do not know of any mammal, bird, reptile, or batrachian which preys upon these snails. Thrushes, which are so notoriously fond of *Helix nemoralis* and *H. hortensis*, find *H. pomatia* too large a pill. As far as my somewhat circumscribed experience is concerned, the larvæ of certain dipterous flies, and possibly those of some Coleoptera also, are the greatest enemies of the Mollusca, more especially during the adolescent stage and hybernating stage (the diaphragm being pierced with impunity); so that protective resemblance to

their surroundings would be of no avail whatever against such insinuating and indiscriminate foes as flies. *Helix pomatia* varies considerably in size, but altitude does not seem to affect it in this particular at all, at least in the Cotteswolds.

A precisely parallel case is presented to the preceding as regards coloration in respect to the environment in *Pomatias elegans*, which ranges up to about 900 ft. or thereabouts in the Cotteswolds, and discloses two extreme forms, a dark and a light, the same as the "Roman," the former frequenting the woods, the latter being found more especially, but not exclusively, on the stony, sun-scorched slopes, particularly of the western escarpment. A very difficult puzzle to the tyro of the local palæontology is presented by the occurrence of this shell in a sub-fossilized state, often two or three feet beneath the surface, mixed with Brachiopoda and Marine Mollusca of the oolitic period. They can thus be often seen *in situ* upon the edge of a stone quarry, and the interesting question arises as to how they came to occur at such a depth below the surface. Well, I have elucidated the problem—at least, to my own satisfaction—during the season by observing how in dry hot summers the surface of the ground cracks in places, reminding me in a small way of the yawning fissures which I witnessed on the plateau of the Cossya Mountains in Assam after the memorable earthquake of June 12th, 1897. I have no doubt in my mind that the shells are engulfed or washed into the fissures by storms, the fissures subsequently closing, and the shells after the lapse of a number of years becoming eventually fossilized, or partially so. They may be seen in surprising numbers in different places. With them, but as a rule only a few inches beneath the surface, may also be found sub-fossilized shells of *Helix nemoralis*, *Hygromia rufescens*, *Ena obscura*, and a few others, but as yet I have observed no extinct post-glacial species of Mollusca among them.

Most Mollusca in the Cotteswolds, as probably elsewhere, are considerably larger and richer in colour at the lower elevations, especially within the shelter of the woods, becoming smaller and paler in appearance in the higher and more exposed places where greater fluctuations of temperature prevail. This applies especially to *Hygromia rufescens*, which abounds in many localities up to nearly 1000 ft. *Helicella itala* also, which is very large

and opaque white as regards the ground colour, at about 500 ft. or 600 ft. or so, is not much more than half the diameter and semi-diaphanous at 900 ft. to 1000 ft. above the sea-level. To a less degree also *H. caperata* is similarly affected concerning colour, but altitude appears not to influence it in size, for large specimens may be found at all the higher elevations. *H. virgata* is of comparatively larger size—at least, many individuals attain to such—at the lower levels, especially on the lias clay at from 200 ft. to 300 ft., the average becoming smaller the higher the species is found. Although it has a wide area of distribution in the Cotteswolds, it is rarely found in such prodigious abundance as is the case on the chalk downs further south. In the Cotteswolds it seems to abound principally on the higher parts of the pseudo-plateau and hill tops, often in the most exposed places, while few or none at all are to be found below. This, I assume, is owing to the absence of organic competition in the shape of animal enemies at the higher altitudes, otherwise, no doubt but for their presence it would be at least equally plentiful in many lower localities than is the case, and where the climate would be more congenial to its taste. It seems to be the most hardy species of mollusc which we possess, judging from the absence of shelter in the situations it frequents, and at altitudes where the greatest vicissitudes of temperature prevail.

In the case of arboreal species, the presence or absence of shelter afforded by the beech woods appears to have more effect in fixing the morphology than absolute altitude above the sea-level; for many species are much larger and of deeper coloration, or else of a more pellucid character in the former environment, than they are even at lower elevations without. Special mention may be made in this connection of *Helix nemoralis*, *H. hortensis*, *Helicigona arbustorum*, *H. lapicida*, *Clausilia bidentata*, and *Jaminia secale*, among others, while with regard to those which dwell principally in moss and rarely expose themselves to the air, such as *Vitrea crystallina*, I have not observed any apparent diminution in size even at the highest altitudes.

The great majority of the species of Cotteswold Terrestrial Mollusca range up to fully 950 ft. above the sea-level—that is, to the extreme upper limits of the arborescent vegetation. All the slugs are thus found, I believe, with the exception of *Testacella*

maugei, *T. haliotidea*, and *T. scutulum*, alien species which have hitherto been recorded only, as far as I am cognizant, from gardens in the vale, between 50 ft. and 300 ft. above the sea-level, where they were no doubt originally introduced with exotic plants. Another class are confined exclusively to the middle altitudes, apparently the presence of the woodland areas deciding their occurrence in an affirmative way. Among these may be enumerated the local *Ena montana*, *Clausilia rolphii*, and *Hygromia fusca*, with, perhaps, *Helicella cantiana*, *Azeca tridens*, *Cœcilioides acicula*, and *Succinea oblonga*. As regards the first named, *Ena montana*, this only occurs, according to my present knowledge, in three different stations here, but will no doubt be eventually found in others when looked for, as in one of them, which I consider to be its metropolis in the Cotteswolds, it occurs in considerable abundance. It is found exclusively in the beech woods at not less than 400 ft. and never more than 750 ft. above the sea-level, according to my experience. I distinguish three forms with reference to coloration, *viz.*: (1) what may be termed the typical form of a dark brown, fairly pellucid; (2) of a pale brown and semi-diaphanous, which I call var. *cotteswoldensis* (mihi); and (3) of a pale opaque brown, the var. *birdlipensis* (mihi). Although I have examined a considerable number of specimens at different times, I have hitherto failed to meet with the white aberration *albida*, which I have, however, found in the commoner *Ena obscura* on several occasions.

Concerning the local *Clausilia rolphii*, of which, by the way, I have just recently discovered an additional locality (which makes three places where it exists here to my present knowledge), I distinguish two forms as regards colour—the first dark brown and the second with a reddish tinge and somewhat pellucid. In regard to size, they vary somewhat; the more elongated forms I call var. *major* (mihi), and the small stunted specimens var. *minor* (mihi). The common *C. bidentata* also varies considerably in size, the longest being confined to the woods, the shortest being found principally on the higher ground and more exposed places generally.

Of *C. laminata*, I distinguish five different forms in the Cotteswolds. It is often an abundant species up to 950 ft. or so, though in the more elevated and exposed places it assumes a

more stunted appearance, having a much shorter spine and being more ventricose than the typical form found in the woods, where, however, abbreviated aberrations frequently occur also. I call this variety *submontana* (mihi).

Of the arboreal forms there are four distinct varieties, *viz.*: (1) var. *pellucida*, and (2) var. *albida*, which are both of frequent occurrence, the latter occurring in the proportion of about ten per cent. to the whole. The typical form (3), by the way, here as elsewhere is pale brown and fairly pellucid. In addition to the preceding is a pale yellowish brown form, sometimes passing into whitish in the upper whorls—var. (4) *oolitica* (mihi)—constituting a somewhat parallel aberration to the var. *nelsoni* of *Clausilia biplicata*, originally found near Hammersmith by Mr. J. W. Taylor.

Among the highest ascending species in the Cotteswolds is the common *Helix aspersa*, which abounds in gardens at close upon 1000 ft. above the sea-level at one small village. Here it is much sought after by certain men who make a practice of coming round periodically and obtaining permission from the cottagers to look for it among the stone walls, where it hybernates in clusters, and thence the snails are taken to Gloucester, where they are commercially known by the cognomen of "wall-fish," and find a ready sale in this disguise in the various fishmongers' shops.

The form occurring at the highest elevation is considerably smaller and darker than the one found in the vale. The beautiful variety *exalbida* I have collected between the altitude of 400 ft. and 750 ft. above the sea-level.

As may be expected from the fact that they are all of Arctic distribution, the following species range up to the highest altitudes in the Cotteswold Hills, *viz.*: *Pyramidula rotundata*, *Punctum pygmæum*, *Euconulus fulvus*, *Vallonia pulchella*, and *Cochlicopa lubrica*, which, with other Cotteswold species, have been recorded for Arctic Norway, Lapland, and Siberia by Dr. Middendorff, Nilson, and others. With them may be mentioned the following species of a less boreal nature, *viz.*: *Jaminia secale*, *Clausilia bidentata*, *Ena obscura*, *Hygromia hispida*, *Vitrea crystallina*, *V. alliaria*, *Zonitoides nitidus*, *Vitrina pellucida*, and *Pyramidula rupestris*, which latter sometimes occurs in thousands on

the stone walls in various localities up to 950 ft. or thereabouts. In the mountain regions of the North of England and in Scotland much more might be accomplished in tabulating the altitudes to which the various species ascend than in the Cotteswolds. For example, in the Grampians, on Ben Lawers in Perthshire, Dr. Grant Guthrie has recorded *Clausilia bidentata* from an elevation of 2400 ft., while more recently the sub-Arctic *Limax tenellus* has been discovered in abundance in the elevated pine woods of the great Forest of Rothiemurchus, in the same region, by the Rev. Robert Godfrey. It is thus very possible that there are several Arctic and Alpine species, or at least varieties, of Mollusca yet to be added to the British fauna from a study of their vertical distribution in this country.

The following table must only be considered of a temporary character. The chief difficulty in the way of tabulating the vertical distribution of the Cotteswold Mollusca is to be found in procuring data for their inferior rather than their superior range, owing to nearly all the lower levels being monopolized by agriculture; while, on the other hand, some species undoubtedly will require to have their area of occurrence extended upwards. It will be found, however, approximately accurate, and will serve its purpose sufficiently, perhaps, as a suggestion as to what could and should be done in other districts, if conchologists would only deviate from the frequent course of forming huge collections without reference to the important scientific service which would undoubtedly accrue from a study of the environment whence their specimens were obtained. This is a subject which the Conchological Society might undertake officially in the same way as has been done in recording the horizontal distribution.

If in penning these few lines I shall have been the means of inducing others to take up a branch of study which has afforded so much pleasure to myself, I shall feel sufficiently rewarded for the trouble I have taken.

PIONEER LIST OF THE COTTESWOLD TERRESTRIAL MOLLUSCA, GIVING THEIR VERTICAL DISTRIBUTION (BASED ON THE LIST OF LAND AND FRESHWATER SHELLS OF GLOUCESTERSHIRE IN WITCHELL AND STRUGNELL'S 'FAUNA AND FLORA OF GLOUCESTERSHIRE').

CENSUS OF SPECIES. The Nomenclature and Arrangement in accordance with that adopted by the Conchological Society, 1904.	Approximate Absolute Range of Altitude above the sea-level (in feet).	Occurrence in Dr. Watson's Lower Agrarian Zone (0–900 ft.).	Occurrence in Dr. Watson's Mid-Agrarian Zone (900–1080 ft.).†
Testacella maugei	0–300	*	
T. haliotidea	0–300	*	
T. scutulum	0–300	*	
Limax maximus	0–950	*	*
L. flavus	0-950	*	*
L. arborum	–950	*	*
Agriolimax agrestis	0–950	*	*
Milax gagates	–750	*	
Vitrina pellucida	0–1000	*	*
Vitrea crystallina	0-1000	*	*
V. ceilaria	0-950	*	*
V. rogersi (= *glabra*)	-950	*	*
V. alliaria	0–1000	*	*
V. nitidula	0–950	*	*
V. pura	0–950	*	*
V. radiatula	–950	*	*
Zonitoides nitidus	0–1000	*	*
Euconulus fulvus	0–1000	*	*
Arion ater	0–950	*	*
A. hortensis	0–950	*	*
Punctum pygmæum	–1000	*	*
Sphyradium edentulum	?	?	
Pyramidula rupestris	500–950	*	*
P. rotundata	0–1000	*	*
Helicella virgata	200–1000	*	*
H. itala	400–1000	*	*
H. caperata	0–1000	*	*
Cochlicella barbara	?	?	
C. cantiana	500–750	*	
Hygromia fusca	400–750	*	
H. granulata	?	?	
H. hispida	0–1000	*	*
H. rufescens	0-1000	*	*
Acanthinula aculeata	–750	*	
Vallonia pulchella	–1000	*	*
V. costata	–750	*	

Census of Species. The Nomenclature and Arrangement in accordance with that adopted by the Conchological Society, 1904.	Approximate Absolute Range of Altitude above the sea-level (in feet).	Occurrence in Dr. Watson's Lower Agrarian Zone (0–900 ft.).	Occurrence in Dr. Watson's Mid-Agrarian Zone (900–1080 ft.).†
Helicigona lapicida	–950	*	*
H. arbustorum	0–950	*	*
Helix aspersa	0–1000	*	*
H. pomatia	400–950	*	*
H. nemoralis	0–1000	*	*
H. hortensis	0–1000	*	*
Ena montana	400–750	*	
E. obscura	–1000	*	*
Cochlicopa lubrica	0–1000	*	*
Azeca tridens	400–750	*	
Cœcilioides acicula	600–700	*	
Jaminia secale	400–1000	*	*
J. cylindrica	–750	*	
J. muscorum	?	?	
Vertigo minutissima	?	?	
V. antivertigo	?	?	
V. pygmæa	?	?	
V. pusilla	?	?	
Balea perversa	?	?	
Clausilia laminata	–950	*	*
C. biplicata	?	?	
C. bidentata	0–1000	*	*
C. rolphii	500–750	*	
Succinea putris	0–	*	*
S. elegans	0–	*	*
S. oblonga	–750	*	
Carychium minimum	–1000	*	*
Pomatias elegans	400–950	*	*
Acicula lineata	?	?	

† The highest point in the Cotteswold Hills is Cleeve Cloud, near Cheltenham, which is 1081 ft. above the sea-level, according to the trigonometrical survey.

HUNTING THE HUMP-BACK WHALE (*MEGAPTERA LONGIMANA*) IN NATAL WATERS.

By H. W. Bell-Marley.

(Plate I.)

Until very recently nothing had been published or made known about the habits of these Whales. In the earlier attempts at classification Mr. Beddard* shows how much we may read with caution or accept as authentic, and regards this Whale as known under no fewer than twelve names, the late Dr. Gray being responsible for four of these synonyms. This Whale's great distribution has probably caused the difficulties in the fixing of the species. Mr. W. L. Sclater† writes:—"Whether there are several species of Hump-back Whales or only one widely distributed species cannot be definitely settled until further comparisons with more material are possible."

It having been noticed, between the months of May and August, that these Whales passed in great numbers between Natal and the Delagoa Bay coast, a company was formed last May by some enterprising Norwegians, the Government having given permission for a shed and machinery to be erected on the Bluff side of the Channel. Catches of one or two Hump-backs a day made it soon evident that this speculation would prove a financial success, the first capture taking place on July 3rd; and, without troubling the reader too much about statistics of any kind, some idea of the value of this cetacean's oil may be obtained. The 'Board of Trade Journal' says that "during September oil to the value of £3397 was shipped from the Port of Natal to the United Kingdom and elsewhere," as many as ninety-five to one hundred Whales being cut up for this purpose, one Whale averaging as much as six to eight tuns of oil.

* 'A Book of Whales,' p. 164.

† 'Mammals of South Africa,' ii. p. 183.

Wishing to witness a hunt, on Sept. 5th I accepted the captain's invitation, and embarked on board the whaler 'Ornen,' a fourteen-ton flat-bottomed tub, the usual stamp of vessel one sees around the coasts of Iceland. She was getting up steam as I stepped aboard just before six o'clock, and I made a light repast of some biscuits and ship's coffee with Capt. Andersen, as I anticipated some rough weather the next few hours at sea. A quarter of an hour later we prepared to move out, by hitching off and making for upstream a few yards distant, where everything had been prepared at the station for the removal by us of an old carcase. The blubber having been stripped off in quick time, this lump of flesh was connected by guys to the winches, and then wound with a splash into the sea, where it floated, and was again made fast to the port-bow. Turning round, we made for the bar, crossing it a few minutes to seven o'clock. We commenced our journey in earnest by getting tackle and blocks into ship's order; the cargo—one quivering mass of putrefaction—I was informed, was to be let adrift when the stream had been reached, a matter of another hour or so. The wind veered round, almost paralysing my olfactories by the nauseous air we breathed, and the spice of the promised adventure lost much of its interest.

To those whose stories of Whales date back to their school days, and which were garnered from the pages of Kingston and Ballantyne, the proceedings are somewhat unorthodox.

A number of sea-birds that had followed us all along were now joined by others, which, excited at the prospect of a meal, kept hovering around us at close quarters, screaming and uttering all sorts of mournful cries. With one exception I was able to recognize some familiar types, and, as my observations must not take up too much space, I will enumerate a few species only.

Among the *Gaviæ* was noticed *Larus dominicanus*, a bird common along the whole coast; they were in company with some smaller birds, which I thought to be young Gulls. *L. cirrocephalus*, Grey-headed Gull. Several old birds.

Of the *Sterninæ*, Mr. W. L. Sclater mentions no fewer than seventeen species as inhabiting these coasts.

I made notes of the following stragglers, for such I believe

them to be, and as having come up from East London and Bird Island with the fishing-boats :—

Hydrochelidon hybrida.

Sterna bergii. — *S. media.* The latter and active little bird —a frequent visitor of ours—prefers, it appears, our bay with its sand-banks to the more lofty and breezy sides of Table Mountain.

The Giant Petrel (*Ossifraga gigantea*), fairly common, with its expansive wings of brown; it rarely ventures inside the Channel. It is what might be called a sociable bird.

Lastly, a single specimen and rarer bird, which I find I have queried *Sterna saundersi.*

The 'Ornen' having come to a standstill, the excitement of these birds I found was due to the carcase, which, owing to the heavy sea and strain put upon it, had come to grief, the stomach having opened out, allowing the viscera to divide. The captain seeing this ordered the men to let way. Immediately, to our relief, it swung round and floated quickly out to sea, with the whole host of birds fighting and screaming in its wake.

It was near ten o'clock when the skipper changed hands. The morning which looked so unpromising now commenced to brighten up with a change of wind. The mate asked me if I would care for some breakfast? I declined, the dead Whale still being fresh in my memory.

The breakwater was now just visible, the Bluff Lighthouse in the hazy distance being silhouetted by its verdant surroundings. The captain, coming on deck, began to see that everything was in working order, the duties of the harpoon-gun being his, and sent the mate aloft to a barrel at the masthead —the old crow's-nest—the wheel being handed over to the helmsman. Here I may make some remarks on the deadly weapon upon which the sport of the day depended. The gun is screwed down at the extreme end of the bow, moves round on a swivel, and discharges a harpoon nearly six feet long, to which is screwed an explosive in the head of the projectile, behind which again are the three barbs or prongs which, if the fuse be correctly timed, open out; but they will also unlock independently of the bomb. The weight of this harpoon is about

112 lb., and, attached to a cable of some twenty-five fathoms, is placed within the gun's muzzle.

We had been cruising around when, without any warning, a large Whale hove in sight, probably not more than one hundred yards distant. We seemed to have frightened it, and, not wishing to run any risks, it dived without exposing either its head or pectorals, but I had time to see its hump and massive back, its tail only coming into view when the rest of its body was covered up. We saw nothing more of it, although we stood by some twenty minutes. The captain all this time had not removed his eyes from the place where it went down, and now called out something in Norwegian to the man above, and I noticed the course was altered, and the reason for this, I was informed, was that sport would be later this day, as the Whales were still at breakfast.

With Captain Andersen I indulged in a smoke and chat, and we exchanged confidences, so far as our limited knowledge of each other's language would permit, when suddenly the tranquillity was broken by the report of a gun, followed shortly after by that of another. In the hazy distance, which might be a little over one and a half nautical miles, we were able to see the other whaler's ('Jupiter') white barrel and a little of her hull. On our arrival home we heard the news of this whaler's record catch, the captain having come up with the "school" quite early.

We passed this whaler and steamed straight on, it being obvious no time was to be lost, as ahead of us, for the first time, we saw little white puffs everywhere, though the Whales remained hidden. We were not long in overtaking them, and as we silently approached, their snorting became more audible, and we perceived hurried strokes of their tails, but it was some time before they had courage enough to let us pass them. The 'Ornen' slackened down apace, and as she did so this large assembly of Whales (twenty or more) commenced their acrobatic turns, and I have still in my eye the picture these cetaceans presented, and cannot refrain from dwelling upon it, for I am not likely to forget a scene so unlike anything else in the great field of big game.

Under an opaque sky, and overhead the sun enveloped with a

nebulosity that predicted a scorcher, these beasts splashed and snorted all around us, our approach, if it had been noticed, making no difference to them as they pursued their sports or affections unheeding. Without suspicion they rose and dived under our bows, so that it was with difficulty a collision with them was averted. Two Whales occupied my attention for some time by their extraordinary behaviour, for no sooner did one appear to breathe than the other, coming up at the same time, would prepare to assail it in a fashion I have not seen or heard of before; and it appeared that the first Whale, wishing to avoid the other's interference, would before diving roll over and use one of its pectorals on the flanks of the other. I saw them again come up together, and both seemed blown out before they finally disappeared, and this time they made some quick rushes through the surface, as if racing each other. One Hump-back, later in the noon, rose out of the water about two hundred yards distant, the striking of the water with its tail being distinctly heard on board, and this appeared to be a solitary one, as we could see no others in that direction. I also witnessed what was evidently a fight with four Whales; it needs little describing beyond stating that one of the pack, possibly larger than the others, and whose great pectorals made him more conspicuous, kept swinging his tail when half his body was under water. Once only I saw two young Whales playing away from their adults; they were very timid, so it was impossible to see much of them.

I had reason to notice, and I think it worthy of attention, that the Hump-back (or, more correctly speaking, *Megaptera longimana*) is a poor blower for so large an animal; of its timid and shy disposition we have already spoken, and from the fact that no Whales were noticed till late in the day, we may reasonably conclude their absence was due to the large shoals of Herrings (commonly called Sardines in Natal) and other fish that about this period of the season make their way up from the Cape or Agulhas to these shores.

In swimming and diving the tail does all the work, but it might be observed, on alarm or suspicion of danger, the fins are not raised out of the water preparatory to diving. When watching these animals' movements there is nothing graceful

about them. After coming up for air and to enable them to dive down again, both pectorals were used for this purpose, and I observed further that the tail, by the various twists it gave, proved what a disadvantage the Whale was put to, and the exertion necessary to bring this about.

For nearly one hour we had been cruising in and out of this large "school" or company of Whales, and having slowed down took things easy, but it was some time before the captain (who all along had been scanning the sea with his glasses) had fixed upon the object of his choice, when with full speed ahead we swung, as it were, sharply round—and these little steamers can move, as I shall presently relate. A large Hump-back—or, as it is known to the men, "Knoe"—appeared a short distance off, but I could see half of its proportions only. We made for the crest where it had just disappeared, but the 'Ornen' overshot her mark by a few yards, and we waited again, rocking gently to and fro. The captain, having once more taken up his duties, showed his great impatience by swinging the harpoon—a manner I have noticed among good shots—and every ripple was watched for the Whale's whereabouts. Its reappearance was a matter of but a few minutes. Away to starboard a watery depression appeared, caused by some disturbance beneath, and to this we made, when with a great snort it emerged, somewhat raising its head, perhaps to enable it to see what we are. Whilst we were watching this monster another appeared just as the first was about to dive; they went down together, the fin of one striking the other in so doing.

But now the captain saw his chance, and swung round the harpoon on the dorsal of the second Whale as it was about to disappear. With the report the cable flew away, and for a few moments shook; then it started to vibrate and ran out; all now became excited, and the skipper at once prepared to recharge the gun, a process lasting a few minutes. After seven minutes the captive came up, blowing hard, and it was seen at once that it was badly hit, though it did not dive for some seconds. It then turned over by putting all its force into a long plunge, as if trying to rid itself of the instrument of torture that held it, and which had entered below the back. At this time a great strain was placed upon the "manilla," and it appeared to me

remarkable that it did not snap, so to avoid accident—for the Whale was making speed and had doubled towards the rudder—the captain ordered eight knots astern, then a quick manœuvre, and we spun round in remarkable time, only just preventing the wounded animal from coming up under the ship's stern. On its appearance this time it could be seen at once that it was exhausted, and blood changed the colour of the sea in several patches; but what was most surprising, another Whale, which may have been its mate, kept diving under the captive, possibly exhibiting the sympathy of one for the other.

The Whale, still finding itself prisoner and its strength going, prepared for one final attempt to release itself of the harpoon by diving down and lashing out with its tail; the other one did likewise, only in a quicker way. Preparations were now made to haul the captive in; as the pulls on the rope became more frequent it made feeble attempts to dive, the other cetacean having now disappeared as mysteriously as it came.

The harpoon was once more brought to bear on the dying Whale whilst it is floundering about, and the bomb strikes and bursts, the sound being distinctly heard by us. As soon as it received its quietus, the shock caused the Whale to bound upwards, and strike out with its tail and pectorals; then the whole body quivered for a few moments, the tail being the last to demonstrate once again its wonderful power.

Little more remains to be said about the capture, for having been secured it is now drawn up with the line, and the long flukes cut off. After this a chain cable is stretched round the stump, and then, lashed to the port, it is ready for home. Sometimes only one charge is given, the Whale being dispatched with a long lance, but this dangerous performance has resulted in many accidents.

To revert to the chopping off the tail, we were about fifteen miles out when this Hump-back—a fine bull, over forty feet long—was taken. No Sharks had been noticed during the day, only some Dolphins, and we (or at least myself) were not a little surprised to see that a large congregation of these brutes, which had been attracted by the splashing, had now put in an appearance. They fought for the pieces of the tail, so

that it was with difficulty we prevented them from tearing the throat out of the Whale, and on this occasion, giving a hand, with a long pole with a hook at its end, I finally succeeded in running one through the gills and damaging others. On the 'Ornen' turning about the Sharks left us, but later on, when looking in that direction again, their black dorsals skimming the surface spoke of their disappointed greed.

On our homeward journey (now half-past three) it was noticed that the carcase began to lose its equilibrium, the head being forced under water almost horizontally, as it were, and so, to prevent the chain snapping, a clever mechanical contrivance was brought for the first time into action, and deserves, I think, to be described. A long lance enclosing a metal tube (to one end of which is fastened a rubber pipe, the other end being attached to a pump connecting the engine-room) is forced down into the Whale's body, the air being pumped through the aperture in its point into the stomach until it is raised to the surface again. This invention, I heard, belonged to the mate.

We again made a move, nothing more of interest happening during the afternoon. A small flock of birds, which I judged to be Curlews of some kind (*Numenius*), passed us, bearing down south.

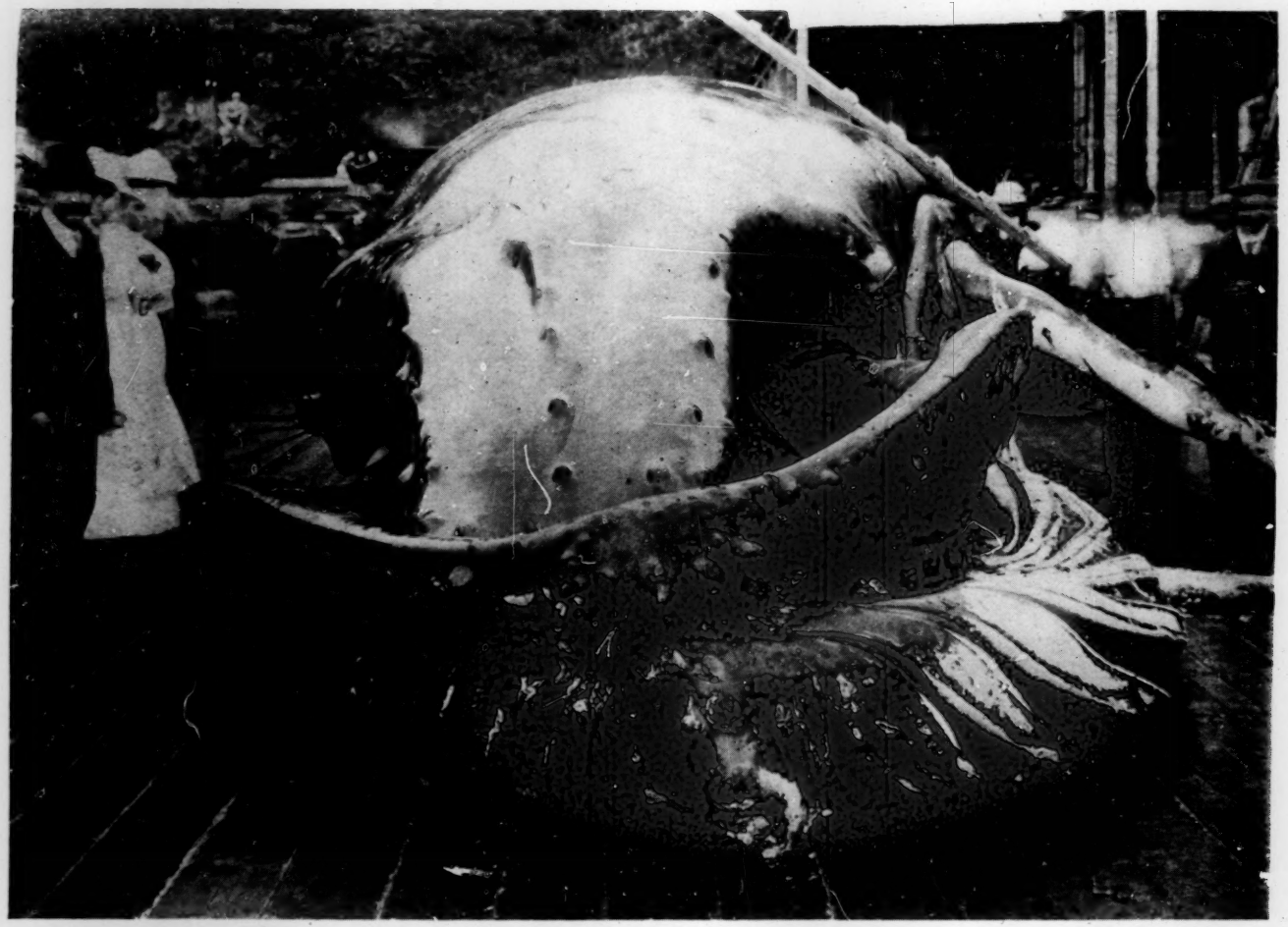
From what had happened and been observed during the short time these Whales were apparently in season, and the great number of this species of cetacean that has been boiled down (no fewer, I find, than one hundred and four, including two Rorquals, between the months of July and early September), goes to confirm what writers have said of it—"never fierce or easily alarmed"—allowing steamers to approach quite closely; and such accidents as getting under the ship's propeller and striking out, as recently happened to the 'Jupiter,' was the result of the wounded animal getting caught in the keel. Most of these and such-like happenings would never take place if the balls burst, or if the time-wires had responded in the first instance.

The question may be asked, On what does the Hump-back feed? In reply I can only relate what I saw when a Whale was being dissected last August. One of the stomachs, which may

have been the first (*rumen*), contained about half a ton of Herrings (*Clupea sagax*), a quantity of greenish water, possibly gastric juices, some fish remains, and, lastly, discoloured sand or detritus. The heads on the Herrings still had some of their red colour preserved.

The fine photo which accompanies these pages was taken on our return from a trip that I made some little time subsequently. One of the two harpoons having entered a few inches below the right eye had doubled itself round on reaching the bones at the occipital region. Note the large warts that adorn the lips; these are called hair-warts, and, according to Beddard, are of an early and rudimentary origin. The tubercles are of all sizes, a large orange being the usual size of a fine one. I have dissected many, and with few exceptions found these so-called hairs very small, whilst many warts are without them. It would appear these hairs are of no use to the Whale, and that it is only a matter of time before they will entirely disappear.

I will now proceed to remark on some of the parasites that are found upon these Whales. For the purpose of specific diagnosis I sent some barnacles and a louse to the Rev. Thos. R. R. Stebbing, from whom I received the following report:—"The barnacle you enclose is *Coronula diadema* (Linn.)." Of another that resembles this, but flatter, on which I made no notes, he goes on to remark: "This is a probable *C. balænaris* (Gmelin), and there appears to be some question whether *C. diadema* is found on these Whales. Your specimens seem to settle that doubt." Attached to one of these shells was a fine example of a stalked crustacean. This he names *Conchoderma auritum* (Linn.). I found them in bunches of five, seven, and nine; the largest would not be longer than eight inches, whilst the smallest only exceeded about half this measurement. Quite an hour after the Whale had been hauled out of the water they still spread out their antennæ-like structures, attached firmly to the epidermis of the pectorals and jaws chiefly; they cannot be removed without a knife. In the young stage *C. diadema* becomes deeply rooted or embedded in the flesh, so that nothing of the shell is visible. On some young Whales these parasites are in hundreds, the larger ones drawing up large protuberances, the scars of which remain long after they become detached; so



THE HUMP-BACK WHALE (*Megaptera longimana*). *cf.* p. 62.

we can have some idea of how their presence must inconvenience the Whale. Its tumbling and leaping out of the sea, which have given currency to most incredible yarns, may be due to this reason. In the larger Whales I found fewer of the smaller ones (barnacles), the larger being more noticeable about the fins, jaws, and vent; the back and sides below the scapulars, under surface of both pectorals and tail being quite free.

In the 'Fauna of South Africa,'* Mr. Sclater, in writing upon the subject of Whale parasites, confuses *Conchoderma auritum* with the ship's barnacle; they are so totally different that one wonders how the mistake occurred.

The louse Mr. Stebbing identifies as *Cyamus erraticus*, and mentions also that this is probably the only species represented. The specimens I sent home were removed off the head near the blowhole, where they had fixed themselves. They appear gregarious in habits, all the sizes keeping together. I noticed, even when exposed to the sun, they made no effort to separate. Some have been found in the gular folds of this Whale.

It is only recently that the great wild preserves of Africa and their large game have received any attention from their Governments; the wanton destruction of the Elephant and Giraffe, and the killing of so many thousands of other species have made it imperative to pass laws protecting them from early extinction. But, it may be asked, what of the other big game—our Whales? If we are to believe all that is told us, the day cannot be very far distant when it will be asked, "Quelles sont les dernières nouvelles à Natal?" and the reply will be, "The last Whale has been killed."

* "Mammals," ii. p. 183.

THE EASTBOURNE CRUMBLES.

By E. C. Arnold.

My acquaintance with the Crumbles dates from the spring of 1899, but it was some years before I came to properly appreciate the ornithological possibilities of the place, and even since I have become aware of them I have seldom, except in the Christmas holidays, been able to get there more than once a week, and I have never visited them in April or August or early September. Under these circumstances my list of interesting visitors must necessarily be incomplete, but even so it seems worthy of being placed on record as being well-nigh unique, if one considers the size of the ground, which is only a few acres in extent, and its proximity to a thriving town. Derelict pots and pans mixed up with an odd bath or so and a sprinkling of motor oil-tins stranded on a mud-flat do not form an ideal setting for the delicate form of a Phalarope, a Wood-Sandpiper, or a Pectoral, yet all these birds and many others have disported themselves in apparent contentment amidst these weird surroundings, and some species, such as the Redshank and Ringed Plover, have even increased in numbers since I first knew the place. The fact is that, excluding the Eastbourne end, the remainder of the Crumbles is extraordinarily well situated and fitted to attract a varied assortment of birds. To the north lies Pevensey Marsh, having on its southern edge, near the 'Archery Tavern,' a fringe of market-gardens, brick-kilns, and marshy pools. To the south lies the sea, and to the east the vast waste of Pevensey shingle.

The "Crumbles shoot" begins with what is locally known as the "Hassock," a sort of mere of the Aldeburgh type, with the aforesaid pots at one end and a bed of reeds at the other—a rare place for Snipe in hard weather. Then comes a strip of brambles, hawthorns, and furze-bushes, which runs round two sides of a depression in the shingle known as the "Ballast-hole,"

where there are numerous shallow pools with muddy borders and single bushes scattered about. The majority are bramble-bushes, but there are also thorns, dog-roses, and a few tamarisks, which seem to attract birds, though they are too thin to conceal them. In the summer the shingle is gay with viper's-bugloss, horned-poppies, sea-campion, and many smaller plants, and, after trying for seven seasons, I have, thanks to the heavy dews of last autumn, successfully introduced four tufts of sea-pink, one of sea-lavender, and three shoots of the famous Cley "bushes" (*Sueda fruticosa*)—these last for the benefit of future naturalists; at present they could barely shelter a beetle between them.

Of the birds that habitually breed here, the Redshank (*Totanus calidris*) is the most interesting. Its breeding flight is sure to arrest attention; it hangs suspended with wings decurved, falls several yards, and then beats up again with whirring wings, like a huge moth. It here makes a very slight nest in quite a small tuft of grass on the shingle. Six or seven years ago these tufts were so few and meagre that the eggs were easy to find. Now they have increased in number, and have ceased to be a guide, and there are more broods brought off every year. Some of the eggs have an unusually beautiful purple tinge about them. The Ringed Plover (*Ægialitis hiaticula*) is more numerous, but its eggs have always been very hard to find, scattered about as the pairs are over a very wide area, and making no nest whatever, unless a lining of very small pebbles can be called one. Myself, I hunted two whole seasons before I found a clutch. I have since found one other, and known a boy stumble on a single egg. The Lapwing (*Vanellus vulgaris*) breeds less abundantly also on the bare shingle. It makes much more of a nest, and all the eggs I have seen here have always had a dark yellow-ochre ground colour. I remember once finding a small chick whose mother went through some strange antics. Instead of feigning a damaged wing, she flew at a neighbouring bank of shingle and proceeded to climb it, much as a Woodpecker climbs a tree. A small and scattered colony of Terns make their nests about the higher shingle, and, like the Lapwings, they mostly use a fair amount of dry grass. I presume they are Common Terns (*Sterna fluviatilis*), and so says Mr. Bates, the local

birdstuffer, but Capt. Knox, in his 'Ornithological Rambles in Sussex,' talks of Arctic Terns breeding on this shingle, and, as I have never shot one of these, I cannot say for certain which they are. I judge them to be Common by the note. It is at present the object of my ambition to find a Dunlin's nest on the Crumbles, and thus add it to the list of Sussex breeding birds. I often see the bird in spring, and have several times seen *pairs* about for days in May and June, and have heard of eggs being found, but never so far from the finder; the information has always been second-hand. Of the smaller breeding birds, the most interesting is the Yellow Wagtail (*Motacilla raii*). It has increased as a breeding species with the increase of the grass, and it nests, like the Redshank, in a tuft. The same may be said of the Reed-Bunting (*Emberiza schœniclus*). I once thought the Blue-headed Wagtail was nesting here, but could never prove it.

The strip of furze, &c., between the "Hassock" and the "Ballast-hole" produces nests of the Sedge-Warbler, Whitethroat, Nightingale, Linnet, Greenfinch, Chaffinch, Hedge-Sparrow, and Red-backed Shrike, and I have seen a Cuckoo haunting it in June. Autumn always sees an influx of waders, which pass in lesser numbers in spring. They are mostly Dunlin, with a few Knot, Grey and Golden Plover, Common and Green Sandpipers, Curlew-Sandpipers, and Little Stint. The last-named may be regularly expected, though they are doubtless overlooked, for a Little Stint, puffed out, may easily pass for a Dunlin, unless one looks specially for its shorter beak. I have also seen it more than once late in the spring. In July we get a return passage of the Cuckoo. In September Wheatears are common, and also Pied Wagtails and Meadow-Pipits; and in October a flight of Ring-Ouzels is no uncommon event. Later on, beside the commoner finches, I have met small flocks of Goldfinches and Snow-Buntings, with an occasional Brambling or Redpoll or Goldcrest, and have known birdcatchers to take the Shore-Lark (*Otocorys alpestris*) and Lapland Bunting (*Calcarius lapponicus*), while the commoner Gulls are always passing, and are often present in large numbers. Hard weather brings Common Snipe in large wisps, and a few Jack and Water-Rail, and at times a Coot. A few Geese pass over, but generally high up, and

sometimes the duck-shooting is for a day or so quite good, *i. e.* until the lagoons are frozen. Mallard come nearly every night, and I can vouch for the appearance of the following:—Wigeon, Teal, Scaup, Golden-eye, Tufted. I have also heard of Pochard, Sheld, and Shoveler being shot, and Mr. Bates has three Ferruginous Ducks in his possession, which claim to have been secured on one of the ponds. Herons from the Hurst-montceaux herony are common. I have seen seven at once. I have never encountered the Bittern so far, but in December 1905, in a garden near the 'Archery Tavern,' a man, going out to gather cabbages, nearly stepped on one squatting amongst the stalks. He gave chase, and was a good second up to the garden-wall and no further, for the Bittern just cleared it and he just didn't. Crows, both the Hoodie and the Common, are to be seen daily foraging in the winter, and often a Kestrel hovers over the more grassy portion of the "Hassock." Dr. Colgate once saw a Raven shot there during a fog, and I saw a Peregrine pass one evening just before flight-time. I have only heard of one Woodcock. It was killed by some rabbit-shooters after they had peppered one of their own party in the face at the first attempt.

The following perhaps deserve dates:—

1901.

Sept. 26th.—Immature Red-necked Phalarope (*Phalaropus hyperboreus*) on the "Hassock." Its flight reminded me of a dragonfly.

1903.

July 22nd.—Saw and heard a Temminck's Stint (*Tringa temmincki*); it hung its legs a good deal as it flew.

Sept. 20th.—Mr. A. H. Streeten and I saw a Bluethroat (*Cyanecula suecica*). We walked it about for a long time, and often had it only a few yards off. There was no mistaking the half-red tail, but we never could get a view of the breast, nor have I ever managed to do so in Norfolk. This bird behaved much like a Robin.

26th.—Got a Blue-headed Wagtail (*Motacilla flava*), either an immature or a mature bird in autumn plumage. There were others about, as there often are in September.

1904.

Sept. 17th.—A Ruff (*Machetes pugnax*) on the "Hassock," and a dubious small duck.

Nov. 17th.—Got a Water-Pipit (*Anthus spipoletta*) near the lagoons. It was flying with a very dropping flight, and looked large and dark on the wing. The feet were black with light lemon soles, and the light portions of the outer tail-feathers nearly but not quite white. Its throat was whiter than that of a Rock-Pipit, and there was an entire absence of the greenish tinge that pervades the latter, the general hue being more russet. The spots on the breast were also fewer and narrower.

25th.—Got another Water-Pipit near the same spot. Its colour was greyer than the last, and the tail-feathers whiter.

1905.

Oct. 11th.—Went to get a common bird to give a lesson in stuffing, and stumbled on a Grey Phalarope (*Phalaropus fulicarius*)! It appeared to me to swim lower in the water than the Red-necked.

Nov. 16th.—A Sand-Martin still about, and a queer bird of the Bunting type. It was, roughly speaking, like a Corn-Bunting, but much yellower. I thought it might be a female Black-headed Bunting.

1906.

Sept. 20th.—A boy, G. H. Beattie, with a small Winchester rifle, got an immature Glossy Ibis (*Plegadis falcinellus*) near one of the lagoons. By the time it reached Mr. Bates few cared to inspect it too closely. He, however, spurred on by his wife, who had not got to do the job, ploughed through the stuffing gallantly, and it is now at the Institute.

22nd.—Another boy, L. E. Dennys, shot a Red-necked Phalarope (*Phalaropus hyperboreus*) on the "Hassock" amidst the pots and pans. During the afternoon a huge flock of Swallows arrived, with some Little Stint and four Twites.

Dec. 26th.—Got an immature Golden-eye (*Clangula glaucion*) while flighting on the Crumbles in hard weather. It flew far faster than any duck that passed that night.

1907.

Sept. 21st.—There were various small waders, including two

Little Stint and two Curlew-Sandpipers, amongst the pots. L. E. Dennys and I put them up, and one dark bird stayed behind. This he subsequently shot, and it proved to be a Pectoral Sandpiper (*Tringa maculata*). I have now seen this bird three times at least in England, the first time being at Aldeburgh on Sept. 13th, 1900, and the last at Cley several times during September, 1908. In addition, I rather think one passed me in January, 1907, at Pegwell Bay, and Dennys feels sure he saw one at Budleigh Salterton, in August, 1908. I believe it is commoner than is generally supposed, but it is overlooked owing to its silent habits. Its note is a very low "chup," seldom uttered. It is distinctly larger and darker than a Dunlin, and, though it consorts with these latter on the sands, it generally separates when it rises. Through glasses it looks more like a Green Sandpiper with a dark piece on the upper breast. The Aldeburgh bird flew very like a Snipe.

Nov. 1st.—Watched a Short-eared Owl (*Asio accipitrinus*) hawking over the lagoons.

22nd.—Saw what I fancy was the strange Bunting of November, 1905. It was with some Larks, and attracted me by its very yellow rump.

1908.

Jan. 7th.—Visited the Crumbles in the midst of a south-west rain-squall, and got an immature Tufted Duck (*Fuligula cristata*).

Sept. 19th.—Put a Nightjar (*Caprimulgus europæus*) off the shingle.

23rd.—A man got a Hoopoe (*Upupa epops*) near a field of swedes amidst the shingle.

26th.—Got a Wood-Sandpiper (*Totanus glareola*), which when I first saw it was standing on some mud near the pots. It was very tame, quite unlike a Green in this respect, and attracted me by its conspicuous light eye-stripe.

Oct. 7th.—Was pursuing a dubious Pipit when a bird put its head out of a tamarisk-bush. Its strange appearance caused me to divert my aim, and I picked up an Aquatic Warbler (*Acrocephalus aquaticus*), a bird for which I have been searching for fifteen years. Its eye-stripe was most pronounced, more so almost than the stripe down the crown, and its tail-feathers were very pointed. The feet were very light, and it had a more fragile

appearance than a Sedge-Warbler. It was an immature bird. The weather had been very fine and still for some days, and the wind was south-east.

Nov. 17th.—Saw two Dartford Warblers (*Melizophilus undatus*), not in the furze but in some bramble-bushes. I followed them for some time at a distance of a few yards, and often had an excellent view. This is an interesting note, as Capt. Knox mentions that they occasionally frequented this scrub years ago. It is the only time I have ever seen one in it for certain.

The above complete the list of Crumbles birds for which I am prepared to vouch, but it may be worth mentioning that I have heard statements to the effect that the Greenshank, Dusky Redshank, and Spotted Crake have occurred. I myself put up what I judged to be a specimen of the last-named bird in May, and I have watched what I took for a Pratincole and a Grebe which seemed to be a Great Crested in winter plumage. I believe, moreover, that I saw a small flock of Richard's Pipits in the autumn of 1907, and I have seen one very small Lark which struck me as odd, and another of the size of a Sky-Lark, but abnormally dark.

Finally, it is earnestly asserted by Mr. Bates that three Spotted Sandpipers were once shot there in one afternoon. I believe Mr. Gurney has one of them.

AN EARLY WORK ON BIRD-MIGRATION.

By W. Ruskin Butterfield.

It is always interesting, and often amusing, to trace the early attempts to explain such complex phenomena as those of bird-migration. So far as I am aware, the earliest treatise on migration published in this country is a rare duodecimo tract of fifty pages issued anonymously in 1703. Its scope is fully indicated in the title-page, which is as follows :—

> 'An Essay Towards the Probable Solution of this Question. Whence come the Stork and the Turtle, the Crane and the Swallow, when they Know and Observe the appointed Time of their Coming. Or Where those Birds do probably make their Recess and Abode, which are absent from our Climate at some certain Times and Seasons of the Year. By a Person of Learning and Piety. London, Printed for Samuel Crouch, at the Corner of Pope's-Head-Alley, over against the Royal Exchange. 1703.'

After a somewhat diffuse and not very pertinent argument the author announces (on p. 18) his "probable solution," namely, that migratory birds, on leaving this country, retreat to the moon!

Sixty days are allowed (p. 40) for the outward journey, and a similar period of time for the return journey. The explanation of the manner in which the space beyond the earth's atmosphere is traversed is, naturally enough, not very convincing to readers nowadays.

The author's answer to the objection that a bird will require to eat and sleep during the journey is characteristic of his reasoning, and may be here transcribed. He says:—"As to eating, it may possibly be [*i. e.* exist] without in that temper of the Æther where it passeth, which may not be apt to prey upon its Spirits as our lower nitreous Air; and yet even here Bears

are said to live upon their Summer fat all the Winter long in Greenland, without any new Supply of Food. Now we noted before that some of those Birds (and perhaps it may be true of the rest) are very Succulent and Sanguine, and so may have their Provisions laid up in their very Bodies for the Voyage.

"As to Sleep, 'tis very probable that they are in a Sleep or sweeven if not all the Way between the Attraction of the Earth and that of the Moon, to which Sleep the swift acquired motion may very much contribute. . . . Now it is likely these Birds being there, where they have no Objects to divert them, may shut their Eyes, and so swing on fast asleep, till they come where some change of Air (as a middle Region about the Moon or Earth) may by its cold awaken them. Add to this, that this sleep spares their Provisions; for if (as some would have it) Cuckows and Swallows can lie asleep half the Year without eating, why cannot these in as deep a sleep as well for two Months forbear it" (pp. 43–45).

The moon is not, of course, a stationary body in the heavens, and so "it cannot be supposed," our author continues, that the birds at the outset of their journey "direct their Course to the Moon, but rather offended by the Steams of the Earth do tend directly from it, and that straight Line 'tis probable they pursue, till they come so near the Moon, that she is their fairest Object to draw their Inclination; for if the Moon hath a Motion in a Month about the Earth, then at the two Months end they find it in the same Line of direction where it was when they began their Journey; for, suppose it Full Moon at the place where they began, just at two Months end, it will be Full Moon again to the same place which they left; therefore if they proceed in the same straight Line, they will be sure to meet the Moon in their Way. . ."

In a postscript, which occupies pp. 48–50, the author meets the objection which the great distance between the earth and the moon sets up by stating that there may be nearer bodies of small size, which he likens to rocky islets in the sea, "which may be the Recess of these Creatures, and may serve for little else but their Entertainment." And he concludes his essay with the statement, which at any rate few will dispute, that "if

the Moon will not be allowed, some other Place must be found out for them."

With regard to the authorship of the work, in Tonkin's edition of Carew's 'Survey of Cornwall' (p. 83), it is attributed to the Hon. Francis Roberts, though on what authority I have been unable to ascertain. The work was known to John Legg, author of 'A Discourse on the Emigration of British Birds,' as is shown by Legg's criticism of it on pp. 12, 13 of the 'Emigration,' and by some remarks upon the Woodcock, borrowed (without acknowledgment) by Legg. In the earlier work these remarks occur on p. 25; in Legg's book on p. 35.

The views expressed in this tract may seem ridiculous in our day, but it may be suspected that they are not more so than some of the ideas entertained on the subject at the present time will appear to ornithologists of the future.

NOTES AND QUERIES.

MAMMALIA.

Mammals of the Channel Islands.—Since the publication of my Notes on the Mammals of the Channel Islands (Zool. 1908, p. 461), Mr. Sinel tells me that the Bat doubtfully referred to *Barbastellus* has been identified by Dr. Ticehurst, of Guy's Hospital, as a melanic Pipistrelle. This makes only four known species for the Islands, *i. e.* Pipistrelle, Serotine, Long-eared, and Greater Horseshoe—a very small record when one considers the proximity of the Continental species, and one which should arouse the local and visiting naturalists to a closer search for the occurrence of other members of this interesting order in such a favourable district. — R. H. Bunting (Natural History Museum, South Kensington, S.W.).

Correction.—On the last line but six of p. 449 (Zool. 1908), in my "Fish Notes," I referred to Porpoise-hide, a statement which several inquiries on my part have proved to be incorrect. Porpoises *were* sold, and universally believed among the fish fraternity to be used for making leather. In the leather trade *porpoise* is an erroneous term in use for the skin of the Beluga or White Whale, and in some instances for specially prepared horse-hide.—A. H. Patterson (Great Yarmouth).

AVES.

Nightingale breeding in Shropshire. — Mr. A. H. Duncalfe (*ante*, p. 29) asks for information as to the nesting of the Nightingale in this county. It is ten years since I wrote the 'Fauna of Shropshire,' and facts that have come to my knowledge during that period somewhat modify the statements therein. The Nightingale is a regular summer visitor to the country on both sides of the Severn from Bewdley up to Buildwas, and especially frequents the small spinneys in the vicinity of Linley and Broseley. Further to the north and west it is of irregular occurrence, the limit of its range fluctuating from year to year in a manner quite unaccountable. The year 1902 was especially remarkable. At least six pairs took up breeding quarters in the

environs of Shrewsbury. One nest was within two miles of my house. I photographed it *in situ* when it contained five eggs, and after the young had flown took the nest, which is now in Shrewsbury Museum. As a rule the Nightingale keeps to the Severn Valley, but a few isolated pairs have been known to nest in other parts of the county, *e. g.* at Onibury in 1905. — H. E. Forrest (Shrewsbury).

Nesting of the Nightingale (Daulias luscinia) in Staffordshire.— In reply to Mr. A. H. Duncalfe (*ante*, p. 29), the Nightingale occurs most years in this county, and I have authentic records of its having nested in the Rectory Gardens, Hamstall Ridware, in 1897, and at Stramshall, near Uttoxeter, in 1904. — John R. B. Masefield (Rosehill, Cheadle, Staffordshire).

Breeding of Coal-Tit in Wilsden District.—A friend and I were sitting down on the outskirts of Bingley Wood last summer when our attention was attracted by seeing a Tit enter a hole in an old wall at some distance from where we were sitting, and almost immediately come out. Being uncertain whether it was a Marsh- or Coal-Tit, I went and sat down within about four feet of the hole, where, I presumed, would be a nest, when my friend protested that he would give no guarantee to stay where he was until the old bird came near enough for its identification. However, knowing fairly well the habits of this species, I remained in my position. For some time the parent, evidently the female—the male kept at a much greater distance—made several attempts to arrive at the nest, sometimes hovering for many seconds near the hole leading to it, thus clearly disclosing the grey patch on the nape characteristic of the Coal-Tit, but only to retire to an adjacent oak, where it poured forth a volley of notes, in tones scolding, minatory, and objurgatory. Finally, however, it gained confidence and entered the nest, but remained such a time on it that we were induced to have a peep at the nest, but no sooner was this done than the bird resented the intrusion by sparring and hissing in true Tit fashion. It is a singular feature in the history of this species that it should be such a scarce breeder in the district, only three nests having been recorded for over forty years, all of which were built in holes in masonry. In the late nineties I spent a few days between Grange and Windermere, and the Coal-Tit was, next to the Willow-Warbler, the commonest breeding species in early April; three nests were built near my lodging, but, curiously, all these were built in holes in the ground.—E. P. Butterfield (Bank House, Wilsden).

Two Young Cuckoos fed by a Titlark.—A short time ago I called to see an ornithological friend who resides some little distance from this place, and he informed me that last August he had watched a Titlark feed two young Cuckoos near his residence. In reply to my inquiry whether he might not have been mistaken, having suggested after all that there might have been two foster-parents, he declared without hesitation that he had watched a single bird feed one of the Cuckoos, then fly away for a short distance and return to feed the other, and this he had witnessed repeatedly. Two eggs of the Cuckoo in the nest of its dupe is not a very rare occurrence in this district, but up to the present I have never known foster-parents rear two—indeed, the gastronomic requirements of one Cuckoo are so heavy, in addition to its being of such a quarrelsome disposition, that such an occurrence would be of more than ordinary interest. Young Cuckoos are so very fractious, untractable, and of such a wandering nature as to render it not improbable that they may lose their own foster-parents occasionally. — E. P. BUTTERFIELD (Bank House, Wilsden).

Honey-Buzzard (Pernis apivorus) in Staffordshire.—On Sept. 30th last, Lieut.-Col. E. S. P. Wolferstan, of Statfold, Tamworth, reports in 'The Field' that his gamekeeper shot a Honey-Buzzard within half a mile of his house. This record, taken in conjunction with the occurrences of this bird in the Eastern Counties reported by the Rev. F. L. Blathwayt and Mr. Dye (Zool. 1908, pp. 428, 468) in the same month, would seem to show that there was an immigration of this species at that time, and if possible, it would be interesting to ascertain if all the birds obtained were *young* birds, and their sex? We have now six recorded instances of the occurrence of the Honey-Buzzard in Staffordshire, besides Mr. C. Buchanan's statement in 'The Zoologist' for 1856, p. 5096, that the bird nested in this county in the year 1841. The editor of 'The Field,' commenting on the last recorded instance of this bird shot in Staffordshire, says:—"An inoffensive summer visitor, which might well have been spared. Unlike other of the larger hawks, its prey consists chiefly of insects and their larvæ, wasps, bees, beetles, and earthworms." Would that our landowners could be prevailed upon to spare Honey-Buzzards, which then might once more be induced to stay and breed with us!—JOHN R. B. MASEFIELD (Rosehill, Cheadle, Staffordshire).

Snow Geese in Co. Mayo.—A day or so after the great snowstorm of Dec. 29th, 1908, that was so severe over Scotland, parts of England, and the northern counties of Ireland, but which passed so lightly

over this western district—only a few sleety storms and rain, and only one degree of frost on one night—a little flock of four Snow Geese were seen by Mr. Claud Kirkwood, flying over Bartragh Island. They appeared coming from the north, and, having passed over the island, pitched on the sands (the tide being out) about half a mile away, and, after resting for some time, rose and flew up the estuary and river, evidently heading for Lough Cullen. They were easily recognized as Snow Geese by their snow-white plumage and black-tipped wings. During the great snowstorm we had here on Dec. 26th, 27th, 28th, 29th, and 30th, 1906, fourteen Snow Geese visited Bartragh, and were seen by Capt. Kirkwood on the 30th feeding near his stables on the sands. There were four adults perfectly white, and ten greyish birds, evidently immature.—Robert Warren (Moy View, Ballina).

Smew (Mergus albellus) in Middlesex.—Among the Coots and Diving Ducks at Ruislip Reservoir on Jan. 24th was an immature Smew. Although it swam lower in the water than the Pochards and Tufted Ducks it looked but little smaller than they, and, judged by its size, appeared to be a male.—Charles Oldham (Watford).

Black Grouse, ♂ (Tetrao tetrix).—Shot on the Ince Estate in November or December of 1888. This date is taken from a receipt for preserving the specimen, and additionally confirmed by Mrs. Park Yates, the donor of this interesting addition to the local collections in the Museum.*—Alfred Newstead (Grosvenor Museum, Chester).

Mr. T. A. Coward writes :—"The Black Grouse breeds annually on the south-eastern border of Cheshire from Bosley to Whaley Bridge. In the neighbourhood of Ince, Frodsham, and Delamere Forest the bird was formerly common, but has been extinct for some years. At one time, within the memory of old men, the Black Grouse bred in the Forest, and a few years ago Lord Delamere attempted to restock a portion of the Forest, but the attempt failed. This was since 1885—I think about 1900—and Black Grouse were thought all to have vanished long before 1885."

Red-throated Diver (Colymbus septentrionalis) in Hertfordshire.—On Jan. 10th, at Wilstone Reservoir, Tring, I watched a Red-throated Diver for some time ; its slender, slightly upturned bill and speckled back were quite apparent at close quarters. I cannot find any previous record for this species in Hertfordshire.—Charles Oldham (Watford).

* There is a female in the Museum collections from Broughton Gardens, Chester, Nov. 21st, 1892.

Ornithological Records for Chester and North Wales since January, 1908:—

Shoveler Duck (*Spatula clypeata*). — Two males. Cumbermere Abbey Estate, Jan. 6th, 1908.

Merganser (*Mergus serrator*).—Female. Burton Marsh, Dec. 22nd, 1908. A second specimen shot, but not obtained.

Buzzard (*Buteo vulgaris*). — Male. Eaton Estate, Dec. 22nd, 1908.

Peregrine Falcon (*Falco peregrinus*). — Immature. Shocklach, near Malpas, Jan. 4th, 1909.

Raven (*Corvus corax*).—Male. Corwen, 1908.

Pied Flycatcher (*Muscicapa atricapilla*).—Male. Corwen, 1908. The female of this interesting species was seen, but fortunately not obtained.

Great Spotted Woodpecker (*Dendrocopus major*).—Mollington, December, 1908.

Ruff (*Machetes pugnax*). — Immature. River Gowy Meadows, Sept. 30th, 1908.

Goldfinch (*Carduelis elegans*).—A flock of about fifteen specimens observed near Chester, apparently feeding on the seeds of the common thistle, Nov. 21st, 1908. — Alfred Newstead (Grosvenor Museum, Chester).

Ornithological Notes from Scarborough. — A Great Bustard was shot at Cloughton, near Scarborough, about last Christmas-time, by Mr. Bennett, who unfortunately did not have it preserved, but took it home and had it cooked instead of a Turkey for Christmas dinner, and he says it was superior in delicacy to the Turkey. A female Smew has been killed at Rillington, near Scarborough, on Jan. 4th, 1909, being only the second recorded specimen obtained in twenty years. Two Nuthatches were also obtained by Messrs. Raine and Maw respectively (Jan. 5th and 8th last) under riddles in stackyards at Hackness, having gone into the stackyards in search of food during the late snowstorm. This is the first time the Nuthatch has been obtained near Scarborough, but the fact that two birds have occurred in the same week would almost lead to the conclusion that it breeds in the locality. A Whooper Swan (immature) has also been shot by Mr. Clarke on the rocks here (Dec. 28th, 1908). — J. Morley (King Street, Scarborough).

Bird Notes from the Tyrol.—In reference to Mr. Workman's interesting notes on the above (*ante*, p. 30), I would like to state that I visited the Tyrol in 1892; arrived at Muhlau on August 28th and left

September 15th. Muhlau (where I stayed the whole time, with the exception of three days spent on an excursion) is a hamlet about three miles north of Innsbruck. During my stay I could only devote ten days to field work, and several of these were given up to high mountain climbing, where one could not expect to see much bird-life. I am sorry few notes were taken of our common birds, mostly rarities attracting our attention. The first day I saw a Wheatear (*Saxicola œnanthe*), which evidently belonged to the large variety from its size, and the fact that it perched on the top of a somewhat high tree in our garden. Later in the day I took a walk through the pine woods adjoining our *pension*. Several small birds were heard, and momentary glimpses caught of them flitting about among the pines, but it was impossible to identify them correctly. However, numerous Tits of different kinds inhabited the forest. Later on during our rambles we occasionally noticed in clearings Crossbills (*Loxia curvirostra*), and it was most interesting to watch these clumsy-looking but nevertheless acrobatic birds feeding on the seed of the pine-cones; every now and again they managed to sever the stalk, the cone falling to the earth with a thud, but never did a Crossbill follow the cone to the ground to continue its feast. On our first high climb, about 7400 ft., when resting on a narrow ledge of bare rock, I noticed a pair of birds which closely resembled in appearance and actions our Rock-Pipit (*Anthus obscurus*); in fact, they were indistinguishable from our bird, although, as far as I know, this shore-loving bird does not inhabit the Austrian Tyrol. No sooner had the Pipits disappeared than we caught sight of a pair of Chamois grazing far above us. We saw during the day several large birds of prey, but could not name them owing to distance. I may state that these high climbs were not to my taste, but my companion had been an ardent member of the Alpine Club for some twenty years. We should have done much better by sticking to the woods, or the limit of forest growth. Another day I caught sight of a bird which resembled a Magpie minus the long tail, but its appearance was too fleeting to be certain what species it belonged to; possibly it was a Magpie in moult. One day my companion met an Austrian he knew well. This man was an ardent sportsman, and had a small private museum containing birds he had shot. These included Eagles, Owls (different species), Hawks, Falcons, Harriers, Black-game, and Capercailzie, but, most interesting of all, he had an Eagle-Owl (*Bubo ignavus*), which he had kept alive. He found this bird a year before as a nestling at the foot of a tree which contained the nest. He assured us that when an Eagle haunted the neighbour-

hood of his châlet he chained this poor bird to the top of a tree, when it often attracted the Eagle within shot. Soon a boy appeared with a large basket, into which the huge Owl was stowed, and off went our friend with his gun towards the forest, accompanied by the boy carrying the Owl. This man was the only sportsman carrying a gun I saw during my stay.

On one occasion, when proceeding along the bank of a slow river, we saw a Kingfisher (*Alcedo hispida*) and a Water-Ouzel, but the usually rapid flowing streams of the Tyrol cannot suit the habits of the former bird, and I imagine it must be very rare in the mountainous regions. On September 13th, when at the end of a three days' excursion, we completely lost our way in a very desolate region, where there were no marks of the Alpine Club to direct us. I well remember we were toiling up a slope beside a roaring torrent, the noise of which drowned any sound we made during the ascent, and when we topped a rise there in front of us, within twenty yards, on a flat piece of grass, sat a magnificent Golden Eagle (*Aquila chrysaëtus*). On observing us the bird rose in the most awkward, clumsy manner imaginable, with legs stretched backwards, neck stretched to full extent—in fact, it looked like a combination of a Great Coot and Cormorant rising from water, but this awkwardness disappeared in a few yards; then, with neck retracted and legs drawn up, it sailed away in splendid flight. I would like to know if any readers of 'The Zoologist' have noticed this bird rising from a flat surface, and if the flight for a few yards has been as described. On a few occasions, when a boy, I have seen these birds soaring about over hills in wild parts of Scotland, but never had the good fortune to be close to one rising from level ground.

In the Tyrol I found (as I have done in Normandy and Brittany) that the forests were carpeted in some places with such thick undergrowth that only very slow progress could be made, in others there was no undergrowth whatever; the former prevented observation, while the latter is inimical to most bird-life.—J. E. H. Kelso (San Remo, Festing Road, Southsea).